

REMARKS

Before discussing the rejections of the present Office Action, the brief review of applicant's invention is in order.

As described, in part, on page 10 of applicant's specification, the invention is a self-tuned impact damper that uses the speed of a rotating member of turbomachinery to tune the natural frequency of a ball of the impact damper to the frequency of vibration of excitation in the rotating member, thereby, allowing the ball to absorb kinetic energy from the rotating member so as to extend the service life of the rotating member.

As further described, in part, in applicant's specification on page 14, the radii of the ball and spherical trough, in which the ball moves, are selected so as to tune the resonant or natural frequency of the ball to the frequency of excitation encountered on the speed line of a turbomachinery. The ball's natural frequency, that is, the frequency at which the ball vibrates at maximum amplitude, is an integer multiple engine order of the speed of the rotating member of the turbomachinery.. Applicant, on page 14, further goes on to give an example wherein if an engine order is three (3); then the parameters of the ball and the spherical trough are selected so that the ball resonates at three times the rotating speed.

Applicant's self-tuning impact damper and method of operation thereof, in one aspect of the invention, by selecting the radius of the ball, and radius of the spherical trough, both of the self-tuning impact damper, and the location of the ball within the

cavity relative to the axis of rotation of the turbomachine, is such that the natural frequency of the rolling ball when inside the cavity of the rotating component tracks a preselected speed line of the turbomachine. Nothing in the prior art teaches, discloses, or suggests the utilization of the natural frequency of a rolling ball of a self-tuning damper that allows for the natural frequency of the ball to track the preselected speed of a turbomachine, thereby, reducing the detrimental affects to the rotating member and extending the operational life thereof.

Claims 1 and 2 stand rejected under 35USC§102(b) as being anticipated by Darrieus (2,659,243). Applicant respectively disagrees with this rejection for the reasons given herein below.

The Examiner's characterization and comparison to applicant's recited invention is incomplete, because the characterization is devoid of applicant's invention of claims 1 and 2 calling for, in part:

preselecting the radius of the ball, the radius of the spherical trough, and the location of the ball within the cavity relative to the axis of rotation such that the natural frequency of the rolling ball when inside the cavity of the rotating component tracks a preselected speed line of said turbomachine.

Darrieus is devoid of any teaching, suggesting, or disclosing the utilization of a natural frequency of a rolling ball of a self-tuning impact damper to track a preselected speed line of a turbomachine so as to provide for dampening of vibrations being

experienced by the blade or disk of the turbomachine, thereby extending their operational lives and improving machine performance in which the rotating blade or disk is utilized.

Darrieus has no recognition whatsoever of the benefits of the selection of the natural frequency of a rolling ball to reduce the detrimental affects of vibrations of a rotating member, but rather describes his invention in column 2, lines 25-41 as follows:

According to the invention, the revolving reactive forces generating in the bearing as a result of any imbalance brings about corresponding changes in the pressure of the lubricating medium utilized in a bearing, and these pressure changes are then utilized to effect positive and corresponding imbalance compensating changes in position of a plurality of symmetrically positioned balancing members such as balls or rollers arranged for displacement along an accurate path concentric with the shaft axis of the rotating member. The balance is entirely automatic in character, has a high order response sensitivity, and any imbalance is compensated out as soon as the slightest revolving centrifugal force of reaction occurs in the bearings. (Emphasis added)

Darrieus in claim 1 recites, "arcuate chambers positioned symmetrically and concentrically about the axis of said body." This suggests that the radius of the Darrieus chamber is concentric to the shaft, and that it is of a cylindrical shape which is unlike the present invention wherein a ball rolls on a spherical shape, and furthermore, the radius of the present invention is not limited to being concentric with the shaft. More particularly, the radius of the impact damper chamber of applicant's invention is preferably designed to give a particular natural frequency for the rolling ball that is a multiple of the rotor

speed. For such embodiments, the damper chamber of the present invention will probably not be that of Darrieus which is concentric with the shaft.

Darrieus is also silent of any discussion of the benefits of the self-tuning impact damper of the present invention, wherein damper mass (ball) provides damping (vibration reduction). The present invention teaches that the cavity size is selected to ensure impacts which is not the teaching of Darrieus.

The intent of the devices of Darrieus and applicant's invention is completely different. The Darrieus teaches a device that automatically balances rotating bodies. The device of Darrieus utilizes an intricate fluid system to position a mass within the chamber to counteract imbalance. Conversely, the impact damper of the present invention is a device that decreases vibrations of turbomachinery blades or disks. The impact damper of the present invention relies on a ball rolling back and forth in a cavity at a specific frequency, impacting the walls, and thus, reducing vibrations.

Nothing within the four corners of Darrieus teaching the benefits of utilizing pressure changes in a lubricant, and having arcuate chambers positioned symmetrically and concentrically about the axis of a rotating body anticipates, discloses, or suggests, the benefits of the present invention utilizing the natural frequency of a rolling ball of a self-tuning damper to track the preselected speed line of a turbomachine, so as to dampen vibrations experienced by turbomachinery, thereby extending the turbomachinery's operational life and also improve its performance.

The Examiner's anticipation rejection of claims 1 and 2 based on Darrieus devoid of any teaching of the natural frequency of a ball of a self-tuned damper is without merit and needs to be withdrawn.

Claims 1 and 2 further stand rejected under 35USC§103(a) as being unpatentable over applicant's prior art in view of Darrieus. Applicant respectively disagrees with this rejection for the reasons given herein below.

The Examiner's characterization with regard to 35USC§103(a) is similar to the Examiner's characterization with regard to the 35USC§102(b) rejection of claims 1 and 2 in that both characterizations fail to make any mention of applicant's invention of claims 1 and 2 calling for, in part:

preselecting the radius of the ball, the radius of the spherical trough, and the location of the ball such that the natural frequency of the rolling ball when inside the cavity of the rotating component tracks a preselected speed line of the turbomachine.
(Emphasis added)

The Examiner's characterization goes on further to utilize the cavity of Darrieus with applicant's admitted prior art of Fig. 2 for the purpose of aligning the ball.

Assuming for the sake of discussion that Darrieus and applicants Fig. 2 are combinable, even though neither applicant's teaching nor Darrieus' teaching make such a

suggestion, the resulting combination would still be void of applicant's invention which calls for:

preselecting the radius of the ball, the radius of the spherical trough, and location of the ball such that the natural frequency of the rolling ball when inside the cavity of the rotating component tracks a preselected speed line of the turbomachine.

Nothing in Darrieus nor applicant's admitted prior art, taken alone or in combination, being devoid of applicant's selection of the natural frequency of the rolling ball to dampen vibrations, teaches or suggests or renders obvious applicant's invention recited in claims 1 and 2.

For the reasons given hereinabove, it is respectfully solicited that the 35USC§103(a) and the 35USC§102(b) rejections of claims 1 and 2 be withdrawn and that applicant's claims 1 and 2 be found allowable.

Because this Amendment document does not amend any existing claims, pursuant to the revised amendment practice of 37 CFR 1.121 effective July 30, 2003, no complete listing of claims is included herewith.

By virtue of applicant's submitted arguments, it is believed that all outstanding grounds for rejections and objections have been addressed and dealt with and, based thereon, it is believed that the application is now in condition for allowance and such allowance is respectfully requested.

Respectfully submitted,

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